FY-2001 PROPOSED SCOPE OF WORK for: **Project #: 112**

Computer-interactive key to sucker larvae

Lead Agency: Larval Fish Laboratory
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Date: 20 March 2000, Revised 28 April 2000

Category:	Expected Funding Source:
_ Ongoing project	x Annual funds
_ Ongoing-revised project	_ Capital funds
x Requested new project	x Other (expected cost-share of ~$27K by CDOW–GOCO)
_ Unsolicited proposal	

I. Title of Proposal:

Computer-interactive key to sucker larvae and early juveniles of the Upper Colorado River Basin with supplemental description of longnose sucker. (Part 1 of a comprehensive guide to the cypriniform fish larvae and early juveniles of western Colorado and the Upper Colorado River Basin.)

II. Relationship to RIPRAP:

General Recovery Program Support Action Plan item V.C–develop and enhance scientific techniques required to complete recovery actions.

III. Study Background/Rationale and Hypotheses:

Collections of the early life stages of fish are essential to research on and monitoring of razorback sucker (or other sucker) spawning sites and seasons, larval production, transport, distribution, nursery habitat, and survival, and other aspects of early life history. Such research cannot proceed effectively without accurate identification of at least razorback sucker or other target species among collected specimens. Morphological identification requires knowledge of the appearance of not only the target species but all similar species in the waters sampled and the diagnostic criteria for segregating them. For the early life stages of many species, including the suckers and minnows of the Upper Colorado River Basin (UCRB), morphological criteria for identification change dramatically as the fish grow and develop, making diagnosis especially difficult and complicated, as exemplified by the 60-page key in Snyder and Muth (1990) which covers the larvae and early juveniles of just six of the seven species of suckers in the UCRB. Descriptive information and diagnostic criteria must be well founded, sufficiently detailed, and documented in such a way that they are retrievable, usable, and verifiable by any interested researcher, not retained only in the minds of one or a few specialists with whom they may eventually be lost.

The detailed descriptions and key in the Colorado Division of Wildlife (CDOW) guide to UCRB sucker larvae and early juveniles (Snyder and Muth 1990) have served the Recovery Program and research community well, but users have found the very long and intricate key formidable and inflexible, and the document needs to be updated with new information. However, intricate printed keys, such as this one, are very difficult to prepare, correct, update, or expand to cover additional species because each change cascades through most subsequent portions of the key. As a modern alternative, the computer-interactive key proposed herein would be much easier to prepare, update, and expand, and would provide UCRB researchers with a new, much more flexible, and user-friendly taxonomic tool. Users could limit consideration to a subset of species when appropriate and bypass characters that are unfamiliar, difficult to accurately measure or observe, or damaged or missing on the specimen of concern.

Another shortcoming of the 1990 guide was the omission of longnose sucker. It was not included because of budgetary limitations and the improbability of the encountering its larvae or early juveniles in Recovery Program collections. However, with collection of a significant number of juvenile longnose sucker and many larvae suspected to be longnose sucker or hybrids in the lower Gunnison River in 1993, confidence in identification of those and other suckers, was compromised, and the need to comparably describe and incorporate the last of the UCRB suckers in the key became evident. Existing descriptions of longnose sucker larvae by Fuiman and Witman (1979) and Sturm (1988) lack much of the descriptive data and detail needed to directly compare them with species described by Snyder and Muth (1990). The proposed description of longnose sucker larvae and early juveniles and inclusion in the computer-interactive key will facilitate more certain identification of razorback sucker and other larval and early juvenile suckers collected in the lower Gunnison River or wherever else longnose sucker might occur.

IV. Study Goals, Objectives, End Product:

Goal—

- To improve the ability of Recovery Program and other researchers to accurately identify larval and early juvenile suckers collected in the UCRB.

Objectives—

- To update, complement, and complete the existing Colorado Division of Wildlife guide to larval and early juvenile suckers of western Colorado and UCRB (Snyder and Muth 1990) as part 1 of a comprehensive guide to cypriniform fishes.
- To provide proof-of-concept for application of a relatively new taxonomic tool, the computer-interactive key, to larval fish identification.

End Product—

- Manuscript for a supplemental update to Snyder and Muth (1990) with a comparable longnose sucker species account and a computer-interactive key to larvae and early juveniles of all UCRB suckers (program and files on diskette or CD). Publication options will be considered in the final report.

V. Study area:

Upper Colorado River Basin.

VI. Study Methods/Approach:

Task 1: Culture new developmental series of longnose sucker to complement and supplement existing series from east-slope source—

- Acquire fertilized eggs of longnose sucker, preferably from west-slope brood stock (e.g., Gunnison River, Blue Mesa Reservoir).
- Rear and preserve new developmental series.

Task 2: Description of longnose sucker larvae and early juveniles, updates for other species, and comparisons—

- Conduct detailed study of morphological ontogeny of longnose sucker larvae and early juveniles comparable to that previously done for other Upper Colorado River Basin suckers (Snyder and Muth 1990), including meristics, morphometrics, size relative to state of development, pigmentation, and, for metalarvae and juveniles, skeletal features.
- Prepare standard set of eight three-view drawings representative of selected early-life stages of development.
- Prepare descriptive species account identical in format to that for other suckers in Snyder and Muth (1990).
- Examine rare specimens of UCRB suckers and document character states potentially beyond those given in existing species accounts; prepare a list of updated character-state data.
- Revise comparative summary in Snyder and Muth (1990) to include comparison with longnose sucker and any updated data for other species.

Task 3. Preparation of the computer-interactive key to Upper Colorado River Basin sucker larvae and early juveniles—

- Obtain and setup the latest versions of DELTA and INTKEY programs (Dallwitz 1993; Dallwitz et al. 1995) or alternative programs (e.g., LucID) if found more suitable.
- Prepare descriptive data assembled for species accounts of Upper Colorado River Basin suckers in Snyder and Muth (1990) for use by INTKEY (or alternative program), test, refine, and produce a draft interim version of the computer-interactive key.
- Prepare draft introduction and instructions for use of the computer-interactive key.
- Submit draft interim key and instructions to critical review and testing by LFL staff and external volunteers (e.g., Recovery Program researchers, Dr. Dallwitz) and refine the key and instructions accordingly. Consider also feedback following demonstration and hands-on use by participants in 2001 Larval Fish Conference.
- Prepare descriptive data assembled for longnose sucker, integrate this and any updated data for other species with that for the interim key, test, refine, and produce a draft final key; modify instructions as necessary.
- Submit draft final key and instructions to critical review and testing as for interim version and refine key and instructions accordingly to final draft.

Task 4. Manuscript, proposal for publication, project report, and presentation of results—

- Present and demonstrate the interim version of the computer-interactive key at the 2001 Annual Larval Fish Conference (American Fisheries Society Early Life History Section). Use participant feedback to further refine the key.
- Prepare manuscript for a supplemental update to the 1990 guide including the longnose sucker species account and computer-interactive key.
- Investigate options and costs for more formal publication and wider distribution of the supplement; prepare and submit proposal for publication.
- Prepare final report with manuscript supplemental update to the 1990 sucker guide and submit in accord with Recovery Program reporting policy for biological reports.
- Present a paper on longnose sucker development and identification and a demonstration of the computer-interactive key at the year 2002 annual meeting of Upper Colorado River Basin researchers.

VII. Task Description and Schedule:

Task 1. Culture of new developmental series of longnose sucker.—May-August 2001.

Task 2. Description of longnose sucker larvae and early juveniles, updates for other species, and comparisons—July* 2000-September 2001.

Task 3. Preparation of the computer-interactive key to Upper Colorado River Basin sucker larvae and early juveniles—July* 2000-November 2001.

Task 4. Manuscript, proposal for publication, project report, and presentation of results—April-December 2001 (also, UCRB Researchers Meeting, Jan. or Feb. 2002).

* Schedule assumes a beginning date of 1 July 2000 via CDOW-GOCO cost share; otherwise will begin October 1 2000.

VIII. FY-2001 Work

- Deliverables/Due Dates
  - Presentation and demonstration of interim computer-interactive key—Spring or Summer 2001 Annual Larval Fish Conference.
  - Final report and proposal for publication—December 2001.
  - Presentation of longnose sucker description and demonstration of the completed computer-interactive key—January or February 2002 annual meeting of Upper Colorado River Basin researchers.

- Budget (Funding target–Recovery Program, possibly with cost-share of ~$27,000 by CDOW-GOCO)*

	Task 1	Task 2	Task 3	Task 4	Total
- Labor	$4,424	$16,365	$18,483	5,787	45,059
- Travel	595	-	-	1,348	1,943
- Equipment (computer)	-	-	2,000	-	2,000
- Materials & Services	697	1,081	2,153	514	4,445
- Total (Direct Costs)	5,716	17,446	22,636	7,649	53,447
Indirect Cost (15% TDC)**	857	2,617	3,395	1,148	8,017
Total Direct & Indirect Costs	6,573	20,063	26,031	8,797	61,464

* Note that relative to budgets for previously submitted versions of the proposal,

this budget includes: (1) time and travel for capture of longnose sucker brood stock (rather than relying on voluntary resource agency support in this matter), (2) more time for culture of a developmental series of longnose sucker, and (3) additional time for preparation, testing, and refinement of the key.
**Assumes MOU in which the University covers remainder of standard 45% indirect costs rate.

IX. Budget Summary:

FY-2001

$61,464 (assumes MOU for 15% indirect costs) — $34,500 from Recovery Program with possible cost-share of ~$27,000 by CDOW-GOCO.

X. Reviewers:

The proposal has been reviewed by Kevin Bestgen (phone 970-491-1848) and John Hawkins (phone 970-491-2777) of the Larval Fish Laboratory, Colorado State University, Fort Collins, CO 80523. The current version was revised as requested by Tom Czapla (4/25/2000) according to recommendations by persons selected by the Recovery Program for proposed SOW evaluation (Bruce Haines–phone 801-789-0354; U.S. Fish and Wildlife Service, 266 W. 100 N., Suites 2&3, Vernal, Utah 84078–and two anonymous referees).

XI. References:

Dallwitz, M. J. 1993. DELTA and INTKEY. Pages 287-296 *in* R. Fortuner, editor. Advances in computer methods for systematic biology: artificial intelligence, databases, computer vision. The John Hopkins University Press, Baltimore, Maryland.

Dallwitz, M. J., T. A. Paine, and E. J. Zurcher. 1995. User's guide to INTKEY, a program for interactive identification and information retrieval. Division of Entomology, Commonwealth Scientific and Industrial Organization (CSIRO), Canberra, Australia.

Fuiman, L. A., and D. C. Witman. 1979. Descriptions and comparisons of catostomid fish larvae: *Catostomus catostomus* and *Moxostoma erythrurum*. Transactions of the American Fisheries Society 108:604-619.

Sturm, E. A. 1988. Description and identification of larval fishes in Alaskan freshwaters. Master's thesis. University of Alaska, Fairbanks.

Snyder, D. E., and R. T. Muth. 1990. Descriptions and identification of razorback, flannelmouth, white, bluehead, mountain, and Utah sucker larvae and early juveniles. Colorado Division of Wildlife Technical Publication 38.